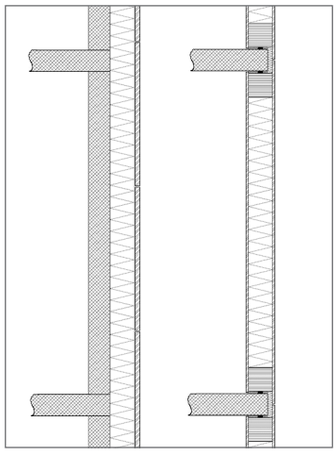
LIGHT WEIGHT, ROBUST AND CLIMATE PROTECTING

The first self supporting house wall made of Carbon-Fibre-Stone (CFS®)

The first self supporting house wall made from fibre reinforced stone plates has been introduced in May 2008 at HTW Chur. The 1 meter wide prefabricated building element is 2,70 meter, thus one story high, and its weight is just about 360 kilograms. The kernel consists of 20 cm thick Polyurethan foam, which is covered on both sides with 2 cm thick CFS®-Plates from Swiss paragneis-granite »Lodrino«, being glued with the foam by standard construction adhesive. The stone panels have been coated by TCT´s CFS®-process with carbon fibre fabrics.

The large sized panels from natural stone are carrying the weight of the ceiling and stories above. U-shaped standard GFK-profiles at the bottom and the upper end of the wall are phasing the forces into the stone panels via the stabilizing carbon layer on the inner side of the stone plates. By means of a swing bearing from CFS® on the top end and at the bottom of the GFK-profiles a continuous force transmission into the wall construction is being realized. The PUR kernel guarantees by a extensive, large area force fit bonding with the CFS®-panels the necessary stiffness of the compound and is intercepting the occurring compressive, tensile and shearing forces. In addition the PUR kernel provides for the requested thermal insulation according to a k-value of Swiss »Minergie«-Standard with a wall of a thickness of in total only 24 cm. The GFK load transmission elements are light weight and together with the PUR foam they are avoiding thermal bridging as efficiently as possible.

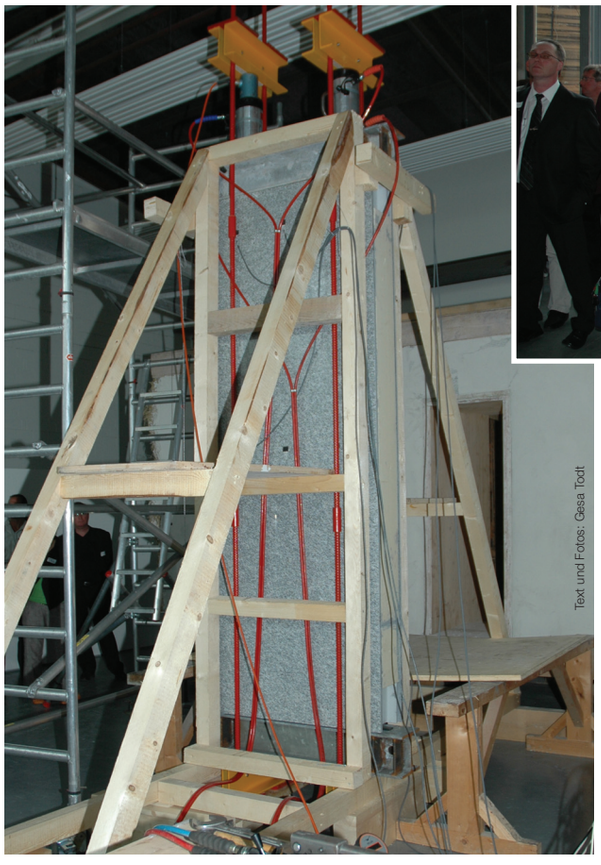
Beautiful and light: only 360 kg of weight for the complete wall element from CFS® (with glued with elongation measuring tape).



Thanks to PUR foam and the both sided coverage with CFS®, the house wall is much lighter and thinner like a comparable concrete wall with non-bearing stone façade construction.

Low weight and less required space

An external thermal insulation of a concrete wall, as it is being applied normally today, needs a lot of space without any technical function. The CFS® house wall reduces the thickness to the minimum needed and thus creates a significant gain of cubature. This gain of cubature plays a significant role in civil engineering today a justifies the



Pressure and longevity tests at HTW Chur: 50 specialists and journalists from civil engineering and natural stone industries have been witness, when 20 tons of load – the comparable weight of three stories – had been applied to the wall without any measurable dangerous deformation.

Text und Fotos: Gesa Todt

higher price in comparison to standard concrete building. The low weight and the slim construction of the wall is possible, since the cross section of the insulation is completely utilized for the stiffness of the wall. The much higher pressure stability of the natural stone compared to concrete is hereby fully used, as well as the two times better ratio of stiffness and pressure stability vs. specific weight of natural stone in comparison to concrete. In combination with the higher stiffness of the total compound – at same values of thermal insulation and two times slimmer dimensions – such a CFS® walls weight is more than 4 times less than that of a comparable wall from concrete with non-bearing stone facade.

Prefabricated house construction – inclusive panelling

A big advantage on top is the possible concept of completely prefabricated elements. With a weight of only 360 kg the elements can be easily transported and installed and connected on site. Laborious and time-consuming works for facade building are eliminated, since the element bring anything with it: thermal insulation and an integrated façade from natural stone on both sides. The inner stone surface can be polished, grinded or simply with raw cutting surface, which is perfectly suited for fettling. The PUR-kernel can be equipped with integrated empty pipes, that are able to accommodate installation facilities, cabling, wiring and sanitary pipelines and installations and can ease the necessary assembling. CFS® walls can be easily drilled and cut, without noteworthy decrease in stability of the CFS® compound. Furthermore whole elements like bay constructions can be easily prefabricated and installed on site.

Another interesting aspect is in the atmospheric environment, a typical and common problem with fully insulated buildings. The water absorbing capability of large scale natural stone plates in the interior is promising a good regulation of humidity. The dew point is located in the outer stone plate - in western climatic zones another important aspect – which eliminates the risk of any building of mildew within the isolation layer. Change of material properties by alternation of frost and dew is not to be expected over long periods of time, since most types of granites are fully frost resistant.

A CFS®-house wall will be able to carry up to 10 or 20 story high buildings, since critical compressive force and load bearing capacity can be engineered by cross section thickness of foam layer and stone plates without significant change in weight. This the material is well suitable for high ceiling rooms and halls. Also roof and floor/ceiling constructions are thinkable with neat, built- in surfaces from natural stone, especially in luxurious environments.

Contribution to clime change mitigation

The ecological balance of the new sandwich construction is very good. First calculations for the presented structure show a 50% decrease in needed energy to build the elements in comparison to conventional concrete architecture with stone facade. On top the expected longevity of CFS® wall elements is by far superior to concrete constructions. In this respect CFS® wall elements contribute significantly to environmental and climate protection not only by less transportation-, production- and installation-efforts, but also by a high level of sustainability.